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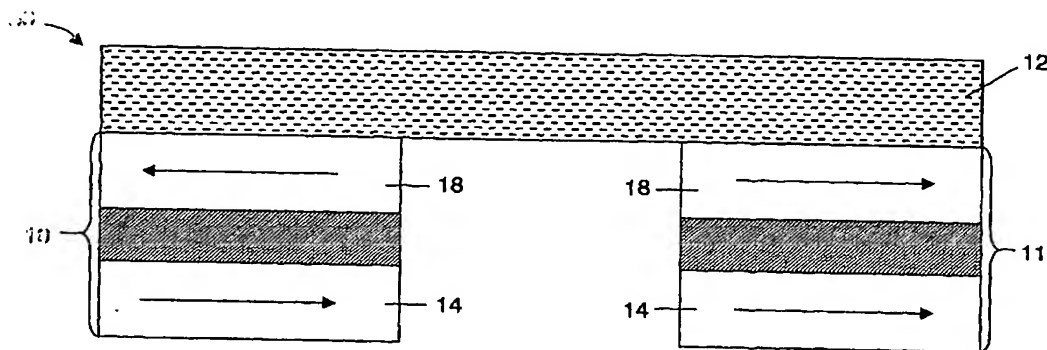
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(54) Title: HARDWARE SECURITY DEVICE FOR MAGNETIC MEMORY CELLS



(57) Abstract: The present invention provides a special structure of magnetic elements, e.g. MRAM elements (10, 11), as a security device (30) for IC's containing magnetic memory cells. The structure may comprise a combination of two or more associated magnetic elements (10, 11) with pre-set anti-parallel magnetization directions. By determining the polarisation directions of the magnetic elements, exposure to an external magnetic field can be detected. Inverse polarisation directions indicate a normal situation, aligned polarisation directions indicate that the MRAM-array has been exposed to an external field. In this way it can be detected whether it has been tried to erase or alter the data stored in the MRAM in an illegal way. The IC can regularly check the resistance of the security system during operation. Upon detection of a field exposure, the IC can erase all MRAM data, or can reset itself or block its functioning.

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B. FIELDS SEARCHED

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 014, no. 249 (P-1053), 28 May 1990 (1990-05-28) & JP 02 066479 A (NEC CORP), 6 March 1990 (1990-03-06) abstract	1-6, 8-12
A	US 2001/033012 A1 (KOEMMERLING OLIVER ET AL) 25 October 2001 (2001-10-25) paragraph '0097! - paragraph '0117! paragraph '0218! - paragraph '0219! -----	1-12

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☒ Patent family members are listed in annex.

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 02066479	A	06-03-1990	NONE
US 2001033012	A1	25-10-2001	AU 2389501 A 16-07-2001
			CA 2395656 A1 12-07-2001
			CN 1433576 T 30-07-2003
			EP 1243027 A1 25-09-2002
			WO 0150530 A1 12-07-2001
			JP 2003519852 T 24-06-2003